Claim Listing

1–24. (cancelled)

25. (currently amended) A method for controlling position or force in an apparatus which has a roll nip between a first elongated rolling device and a second elongated rolling device in a paper or a board machine, the method comprising the steps of:

measuring a variable related to a position of the first elongated rolling device relative to the second elongated rolling device or the force exerted by the first elongated rolling device on the second elongated rolling device;

comparing the value of the measured variable to a preset value of said variable in order to obtain a difference value of the variable;

adjusting on the basis of the difference value of the variable, the position of the first elongated rolling device with respect to the second elongated rolling device or the force the first elongated rolling device exerts on the second elongated rolling device; and

changing a fluid pressure of a hydraulic device or changing a rate of flow of a fluid to the hydraulic device in order to alter the difference value of the variable, by repeatedly driving with a digital signal a plurality of digital valves arranged in parallel to form a flow of fluid which is the sum of the flow from each of said plurality of digital valves, wherein each valve of the plurality has a finite number of discrete states, and wherein driving the plurality of digital valves comprises changing the plurality of digital valves from a first condition where all of the plurality of digital valves are in first particular discrete states directly to a second condition, different from the first condition, wherein at least one of the plurality of digital valves assumes a different discrete state, and wherein the hydraulic device is connected to the second elongated rolling device and changes the value of the measured variable ~~stepwise opening or closing at least one digital valve in a digital valve pack functionally connected to the hydraulic device~~.

26. (currently amended) The method of claim 25 wherein the digital valves of the plurality of digital valves have only two states, open and closed, and wherein the difference value is obtained digitally and defines a digital difference value and wherein the step of changing a fluid pressure of a hydraulic device or changing a rate of flow of a fluid to the hydraulic device comprises the step of, on the basis of the digital difference value, opening selected digital valves of the plurality of digital valves ~~pack~~ whose flow volume achieves a decrease of the difference value.

27. (currently amended) The method of claim 25 wherein the digital valves of the plurality of digital valves have only two states, open and closed, and wherein the step of measuring a variable comprises measuring the position of the first elongated rolling device in the roll nip relative to the second elongated rolling device; and wherein the step of changing a fluid pressure of a hydraulic device or changing a rate of flow of a fluid to the hydraulic device comprises the step of opening selected digital valves of the plurality of digital valves ~~pack~~, whose flow volume achieves a decrease of the difference value at a selected rate.

28. (currently amended) The method of claim 25 wherein the digital valves of the plurality of digital valves have only two states, open and closed, and wherein the step of measuring a variable comprises measuring an amplitude and frequency of vibration in the nip formed between the first elongated rolling device and the second elongated rolling device, and further comprising:

generating a control signal which is an inverse of the measured amplitude and frequency of vibration of the device;

wherein the step of adjusting on the basis of the difference value is an adjustment based on the control signal;

wherein the step of changing a fluid pressure of the hydraulic device or changing a rate of flow of a fluid to the hydraulic device comprises using the control signal to change the rate of flow of the fluid to the hydraulic device by opening and closing selected digital valves of the plurality of digital valves ~~pack~~ on the basis of the control signal in a phase opposite to the vibration so as to actively attenuate the vibration[[;]] ~~changing a fluid pressure of a hydraulic device or changing a rate of flow of a fluid to the hydraulic device in order to alter the difference value of the variable, by stepwise opening or closing at least one digital valve in a digital valve pack functionally connected to the hydraulic device~~.

29. (currently amended) An arrangement for controlling position or force of an elongated rolling device in a roll nip between a first elongated rolling device and a second elongated rolling device, in a paper or board machine, the arrangement comprising:

a measuring device arranged to measure at least one variable related to position or force of the first elongated rolling device to produce a measurement signal;

a control system in measurement receiving relation to the measuring device, the control system arranged to compare the measurement signal with a selected set value of the variable to generate a control signal;

a hydraulic device arranged to change the position or force of the rolling device in the roll nip with a fluid pressure or a flow rate of the fluid; and

a switch connected in control signal receiving relation to the control system, the switch having at least one first plurality of digital valves connected in parallel so as to provide a sum volume flow of fluid which is the sum of the flow from each of said plurality of digital valves, wherein each valve of the plurality has only two or three discrete states wherein each discrete state of each valve is either open or closed and is switchable between said discrete states and wherein the hydraulic device is connected in sum flow volume receiving relation to at least one first plurality of digital valves ~~digital valve pack having a plurality of digital valves, each of said plurality of digital valves being switchable stepwise between on and off on the basis of the control signal,~~ so that the fluid pressure in the hydraulic device or the flow rate of the fluid to the hydraulic device can be changed by regulating the sum volume flow of fluid to the hydraulic device.

30. (currently amended) The arrangement of claim 29, ~~the fluid flow to the hydraulic device is arranged through the digital valve pack, and~~ wherein each valve of the plurality of digital valves is of a size different from the other valves of the plurality of digital valves, and wherein the size of each valve of the plurality of digital valves is selected to form a series of progressively larger digital valves starting with a first digital valve, and wherein each progressively larger valve has twice the flow capacity of the preceding valve in the series ~~wherein the digital valves being such that the volume flow of a larger valve is double that of the valve with the next smaller volume flow~~.

31. (currently amended) The arrangement of claim 30, wherein the measuring device is arranged to produce an analog measurement signal and wherein the control system includes an A/D converter having a digital output connected to the switch ~~the digital valve pack~~.

32. (currently amended) The arrangement of claim 31, wherein the digital output [[doses]] does not pass through a D/A converter.

33. (currently amended) The arrangement of claim 29, wherein the switch in addition to having the at least one first plurality of digital valves ~~digital valve pack~~ has an analog valve arranged in parallel with the first plurality of digital valves, arranged to supply the majority of the flow rate of the fluid to control the position of the first elongated rolling device or of the force the first elongated rolling device exerts on the second elongated rolling device in the roll nip.

34. (currently amended) The arrangement of claim 29, wherein the switch further comprises a second plurality of parallel connected digital valves connected to form a second volume sum flow of fluid which is the sum of the volume flow from each valve of said second plurality of digital valves, wherein each valve has only two discrete states, open and closed, and is switchable therebetween, and wherein the hydraulic device is connected in sum flow volume receiving relation to the second plurality of digital valves ~~digital valve pack, the hydraulic fluid pressure generated by the first digital valve pack and the second valve pack in~~ the hydraulic device being arranged to open[[ing]] and close[[ing]] the roll nip between the first elongated rolling device and the second elongated rolling device.

35. (currently amended) The arrangement of claim 34, wherein the hydraulic device is a hydraulic cylinder having a piston head having a first side and a second side, and a first cylinder portion located on the first side of the piston head is connected in sum flow volume receiving relation to at least one first plurality of digital valves ~~to the first digital valve pack~~, and a second cylinder portion located on the second side of the piston head is connected in sum flow volume receiving relation to the second plurality of digital valves ~~digital valve pack~~.

36. (currently amended) The arrangement of claim 35, wherein the roll nip is arranged to be rapidly opened by opening all of the first plurality of digital valves ~~in the first digital valve pack~~.

37. (previously presented) The arrangement of claim 29, wherein the first elongated rolling device is a reel core, about which a fiber web is reeled, and wherein the second elongated rolling device is a reel cylinder, having a surface arranged to receive the fiber web and feed the fiber web into the roll nip which is located between the reel core and the reel cylinder;

wherein the hydraulic device is arranged to change the nip pressure in the roll nip by being functionally connected to the reel core, said hydraulic device additionally arranged to shift the position of the reel core relative to the reel cylinder; and

wherein the measuring device is arranged to measure the force exerted by the reel core on the reel cylinder in the roll nip or is arranged to measure the position of the reel core relative to the reel cylinder.

38. (previously presented) The arrangement of claim 37, wherein:

the measuring device is arranged to detect amplitude and frequency of the reel core position which defines a vibration occurring in the reel core;

and wherein the control system is arranged to determine a counter-vibration and to generate a counter-vibration control signal; and

wherein the switch is connected in control signal receiving relation to the control system and is arranged to control vibration by regulating the volume flow of fluid to the hydraulic device.

39. (previously presented) The arrangement of claim 29, wherein the first elongated rolling device and the second elongated rolling device are coating rolls, and are arranged to apply coating agent or coating paste onto one or both sides of a fiber web passing through the roll nip.

40. (previously presented) The arrangement of claim 39, further comprising an application means, with the aid of which the coating agent or coating paste is applied to a surface of a first coating roll or of an endless belt rotating about the coating rolls.

41. (currently amended) The arrangement of claim 29 wherein first elongated rolling device and the second elongated rolling device are rolls in a multi-nip calender and load reduction means are provided at least at the end of one said rolls;

wherein the hydraulic device is a hydraulic actuator provided at the end of one of said rolls;

and wherein the at least one first plurality of digital valves ~~digital valve pack~~ is arranged for controlling the hydraulic actuator so that the hydraulic actuator compensates for loads caused by auxiliary equipment on the one of said rolls.

42. (currently amended) The arrangement of claim 41, wherein an additional ~~at least one~~ plurality of digital valves is connected in parallel to form an additional sum flow volume of fluid which is the sum of the volume flow from each valve of said additional plurality of digital valves, wherein each valve of the additional plurality of digital valves has only two discrete states: open and closed, and is switchable therebetween, and wherein the additional plurality of digital valves are connected in sum flow volume transmitting relation ~~digital valve pack is arranged~~ to control hydraulic actuators within the one of said rolls for pressurizing different zones of a roll mantle of the one of said rolls.

43. (previously presented) The arrangement of claim 41, wherein the hydraulic actuator provided at the end of the one of said rolls is arranged to open and close the roll nip.

44. (currently amended) The arrangement of claim 29, wherein the first and the second elongated rolling device are rolls having loading devices therewithin, and wherein ~~the operation of~~ said loading devices [[is]] are arranged to be controlled with the at least one ~~digital valve pack~~ first plurality of digital valves.

45. (currently amended) The arrangement of claim 29, wherein the first elongated rolling device is a doctor blade and wherein the hydraulic device is a hydraulic actuator arranged to control the nip pressure of the roll nip between the doctor blade ~~first~~ and the second elongated rolling devices.

46–52. (canceled)

53. (new) The method of claim 25 wherein the step of driving the plurality of digital valves comprises driving at least 5 valves wherein each valve of the at least 5 valves has two discrete states: open and closed, and wherein the first condition and the second condition are selected from at least 32 possible different conditions the at least 5 valves can be in.

54. (new) The method of claim 25 wherein the step of driving the plurality of digital valves comprises driving at least 8 valves wherein each valve of the at least 8 valves has two discrete states: open and closed, and wherein the first condition and the second condition are selected from at least 256 possible different conditions the at least 8 valves can be in.

55. (new) The method of claim 25 wherein the step of driving the plurality of digital valves comprises driving at least 12 valves wherein each valve of the at least 12 valves has two discrete states: open and closed, and wherein the first condition and the second condition are selected from at least 4096 possible different conditions the at least 12 valves can be in.

56. (new) The method of claim 25 wherein the step of driving the plurality of digital valves comprises driving at least 16 valves wherein each valve of the at least 16 valves has two discrete states: open and closed, and wherein the first condition and the second condition are selected from at least 65,536 possible different conditions the at least 16 valves can be in.

57. (new) The arrangement of claim 29 wherein the at least one first plurality of digital valves comprises at least 5 valves wherein each valve of the at least 5 valves has two discrete states, open and closed, so that the at least one first plurality of digital valves have in combination at least 32 possible different conditions.

58. (new) The arrangement of claim 29 wherein the at least one first plurality of digital valves comprises at least 8 valves wherein each valve of the at least 8 valves has two discrete states, open and closed, so that the at least one first plurality of digital valves have in combination at least 256 possible different conditions.

59. (new) The arrangement of claim 29 wherein the at least one first plurality of digital valves comprises at least 12 valves wherein each valve of the at least 12 valves has two discrete states, open and closed, so that the at least one first plurality of digital valves have in combination at least 4,096 possible different conditions.

60. (new) The arrangement of claim 29 wherein the at least one first plurality of digital valves comprises at least 16 valves wherein each valve of the at least 16 valves has two discrete states, open and closed, so that the at least one first plurality of digital valves have in combination at least 65,536 possible different conditions.